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400 GARDEN CITY PLAZA
SUITE 300
GARDEN CITY, NY 11530

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SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No. 10/735,168	Applicant(s) IDE, TAKAYUKI	
	Examiner Michael P. Roberts	Art Unit 2873	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.
2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.
3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-10 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5)☐ Claim(s) _____ is/are allowed.
6)☒ Claim(s) 1-10 is/are rejected.
7)☐ Claim(s) _____ is/are objected to.
8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.
10)☒ The drawing(s) filed on 12 December 2003 is/are: a)☒ accepted or b)☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a)☒ All b)☐ Some * c)☐ None of:
1.☒ Certified copies of the priority documents have been received.
2.☐ Certified copies of the priority documents have been received in Application No. _____.
3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 20031212.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. **Claims 1-2 and 9-10** are rejected under 35 U.S.C. 102(b) as being anticipated by Kanack '172 (US 5,526,172).

Regarding **claim 1**, Kanack '172 discloses a deformable mirror system (title; abstract; col. 1, lines 9-14) comprising: a deformable mirror (elemental deformable-mirror spatial light modulator DMD SLM 40') which includes a flexible thin film and a control electrode (46a), the flexible thin film having a reflecting surface deformable by an electrostatic attractive force and an upper electrode (Fig. 2; col. 11, line 38-col. 12, line 2, wherein the flexible thin film is made up of metal layer 42 and polymer membrane 41, wherein the metal layer 42 is a reflective surface and the segment 48 of the metal layer 42 and polymer membrane 41 adjacent to electrodes 46a and 46b is deformable by an electrostatic attractive force, functioning as an upper electrode), and the control electrode (46a) being arranged opposite to the upper electrode (Fig. 2; col. 11, line 38-col. 12, line 2, wherein segment 48 of the metal layer 42 and polymer membrane 41 is arranged opposite and adjacent to control electrode 46a); and a power supply configured to apply a potential difference between the upper electrode (segment 48) and the control electrode (46a) of the deformable mirror, and to control the form of the reflecting surface of the deformable mirror to a desired form (Fig. 2; col. 11, line 38-col. 12, line 2, wherein a potential difference is

applied between the segment 48 and the electrode 46a, which necessarily has to come from a power supply, to control move or deflect the reflective segment 48 to a desired curvilinear form); wherein the power supply controls the amount of deforming the reflecting surface (metal layer 42) by changing a duty ratio of a voltage applied across the upper electrode (48) and the control electrode (46a) (Figs. 2-5; col. 12, line 50-col. 13, line 16; col. 13, line 16-col. 14, line 59, wherein the duty cycle of the control signal 102 may be selectively varied which alters the capacitance of the capacitor 40P and adjusts the distance between the segment 48 and the electrode 46a; control signal 102 is applied to the segment 48 via input 108).

Regarding **claim 2**, Kanack '172 discloses a deformable mirror system as shown above, and further discloses a deformable mirror system wherein a frequency of the voltage applied across the upper electrode and the control electrode is higher than a resonance frequency of the flexible thin film having the reflecting surface and the upper electrode (col. 14, lines 5-27, wherein input signal 114 input with the control signal 102 via input 108 to membrane 42 and segment 48 is of a voltage of a higher frequency than a resonance frequency of the flexible thin film, i.e. the metal layer 42 or the metal layer 42 combined with the polymer layer 41 if present).

Regarding **claim 9**, Kanack '172 discloses a method of controlling a form of a reflecting surface (abstract; col. 1, lines 9-14) comprising: applying a potential difference between an upper electrode and a control electrode of a deformable mirror (elemental deformable-mirror spatial light modulator DMD SLM 40') to control the form of the reflecting surface of the deformable mirror to a desired form (Figs. 2-5; col. 11, line 38-col. 12, line 2, wherein a potential difference is applied between the segment 48 of the metal layer 42 and polymer membrane 41, which functions as an upper electrode, and the control electrode 46a to curvilinearly move or deflect

segment 48 by deforming metal layer 42 to a desired form), the deformable mirror including a flexible thin film (Fig. 2; col. 11, line 38-col. 12, line 2, wherein the flexible thin film is made up of metal layer 42 and polymer membrane 41) and the control electrode (46a), the flexible thin film having the reflecting surface deformable by an electrostatic attractive force and the upper electrode (Fig. 2; col. 11, line 38-col. 12, line 2, wherein the flexible thin film is made up of metal layer 42 and polymer membrane 41, wherein the metal layer 42 is a reflective surface and the segment 48 of the metal layer 42 and polymer membrane 41 adjacent to electrodes 46a and 46b is deformable by an electrostatic attractive force, functioning as an upper electrode), and the control electrode (46a) being arranged opposite to the upper electrode (Fig. 2; col. 11, line 38-col. 12, line 2, wherein segment 48 of the metal layer 42 and polymer membrane 41 is arranged opposite and adjacent to control electrode 46a), wherein the amount of deforming the reflecting surface is controlled by changing a duty ratio of voltage applied across the upper electrode and the control electrode (Figs. 2-5; col. 12, line 50-col. 13, line 16; col. 13, line 16-col. 14, line 59, wherein the duty cycle of the control signal 102 applied via input 108 between metal layer 42 of segment 48 and control electrode 46a may be selectively varied which alters the capacitance of the capacitor 40P and adjusts the distance between the segment 48 and the electrode 46a; the more the segment 48 is adjusted away from a normal planar configuration, the more metal layer 42 deforms).

Regarding **claim 10**, Kanack '172 discloses a deformable mirror system (title; abstract; col. 1, lines 9-14) comprising: a deformable mirror (elemental deformable-mirror spatial light modulator DMD SLM 40') which includes a flexible thin film and a control electrode (46a), the flexible thin film having a reflecting surface deformable by an electrostatic attractive force and

an upper electrode (Fig. 2; col. 11, line 38-col. 12, line 2, wherein the flexible thin film is made up of metal layer 42 and polymer membrane 41, wherein the metal layer 42 is a reflective surface and the segment 48 of the metal layer 42 and polymer membrane 41 adjacent to electrodes 46a and 46b is deformable by an electrostatic attractive force, functioning as an upper electrode), and the control electrode (46a) being arranged opposite to the upper electrode (Fig. 2; col. 11, line 38-col. 12, line 2, wherein segment 48 of the metal layer 42 and polymer membrane 41 is arranged opposite and adjacent to control electrode 46a); and control means for applying a potential difference between the upper electrode (segment 48) and the control electrode (46a) of the deformable mirror, and to control the form of the reflecting surface of the deformable mirror to a desired form (Fig. 2; col. 11, line 38-col. 12, line 2, wherein a potential difference is applied between the segment 48 and the electrode 46a, which necessarily has to come from a power supply/control means, to control move or deflect the reflective segment 48 to a desired curvilinear form); wherein the control means controls the amount of deforming the reflecting surface (metal layer 42) by changing a duty ratio of a voltage applied across the upper electrode (48) and the control electrode (46a) (Figs. 2-5; col. 12, line 50-col. 13, line 16; col. 13, line 16-col. 14, line 59, wherein the duty cycle of the control signal 102 applied via input 108 may be selectively varied which alters the capacitance of the capacitor 40P and adjusts the distance between the segment 48 and the electrode 46a).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. **Claims 3-4** are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanack '172, as applied to independent **claim 1** above, and further in view of Fuller '079 (US 6,671,079).

Regarding **claim 3**, Kanack '172 discloses a deformable mirror system as shown above, and further discloses a deformable mirror system wherein a frequency of the voltage applied across the upper electrode and the control electrode is higher than a resonance frequency of the flexible thin film having the reflecting surface and the upper electrode (col. 14, lines 5-27, wherein input signal 114 input with the control signal 102 via input 108 to membrane 42 and segment 48 is of a voltage of a higher frequency than a resonance frequency of the flexible thin film, i.e. the metal layer 42 or the metal layer 42 combined with the polymer layer 41 if present), but does not specifically disclose a deformable mirror system wherein a frequency of the voltage applied across the upper electrode and the control electrode is higher than a higher one of a resonance frequency of the flexible thin film having the reflecting surface and the upper electrode, and a maximum audible frequency. In the same field of endeavor of optical modulation, Fuller '079 teaches of an optical modulator wherein a frequency of the voltage

applied to the modulator is higher than a maximum audible frequency (col. 2, line 51-col. 3, line 35; col. 7, lines 5-40, wherein the driving signals applied to the optical modulator 104 are 5332.1 MHz, higher than any audible frequency; since Kanack '172 discloses a frequency of the voltage applied across the upper electrode and the control electrode being higher than a resonance frequency of the flexible thin film having the reflecting surface and the upper electrode, and Fuller '079 teaches of a frequency of the voltage applied to the modulator is higher than a maximum audible frequency, the combination discloses and teaches of a deformable mirror system wherein a frequency of the voltage applied across the upper electrode and the control electrode is higher than a higher one of a resonance frequency of the flexible thin film having the reflecting surface and the upper electrode, and a maximum audible frequency) for the purpose of modulating light to be transmitted over short, medium, or long distances with reduced distortion (col. 1, lines 13-46, 49-63; col. 2, lines 32-50). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the deformable mirror system of Kanack '172 to have a frequency of the voltage applied across the upper electrode and the control electrode is higher than a higher one of a resonance frequency of the flexible thin film having the reflecting surface and the upper electrode, and a maximum audible frequency, since Fuller '079 teaches of an optical modulator wherein a frequency of the voltage applied to the modulator is higher than a maximum audible frequency for the purpose of modulating light to be transmitted over short, medium, or long distances with reduced distortion.

Regarding **claim 4**, Kanack '172 and Fuller '079 disclose and teach of a deformable mirror system as shown above, and Fuller '079 further teaches of a frequency of the voltage applied to the modulator being higher than a maximum audible frequency, wherein the maximum

audible frequency is 20kHz (col. 7, lines 5-40, wherein the driving signals applied to the optical modulator 104 are 5332.1 MHz).

6. **Claim 5** is rejected under 35 U.S.C. 103(a) as being unpatentable over Kanack '172, as applied to independent **claim 1** above, and further in view of Noe '430 (US 6,678,430).

Regarding **claim 5**, Kanack '172 discloses a deformable mirror system as shown above, but does not specifically disclose that the waveform of the voltage applied across the upper electrode and the control electrode is suppressed in a high-frequency component compared with a rectangular wave. In the same field of endeavor of optical devices, specifically optical modulators and waveguides, Noe '430 teaches of a waveform of applied voltage applied to an optical modulator/waveguide device being suppressed in a high-frequency component compared with a rectangular wave (col. 8, lines 51-65, wherein the signal chosen for driving the modulator is a rounded rectangular voltage or trapezoidal voltage, which suppresses a high-frequency component compared with a rectangular wave) for the purpose of minimizing the required voltage (col. 8, lines 51-65). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the deformable mirror system of Kanack '172 to have a waveform of the voltage applied across the upper electrode and the control electrode be suppressed in a high-frequency component compared with a rectangular wave since Noe '430 teaches of a waveform of applied voltage applied to an optical modulator/waveguide device being suppressed in a high-frequency component compared with a rectangular wave for the purpose of minimizing the required voltage.

7. **Claims 6-7** are rejected under 35 U.S.C. 103(a) as being unpatentable over Kanack '172 in view of Noe '430, as applied to **claim 5** above, and further in view of Little '309 (US 5,926,309).

Regarding **claim 6**, Kanack '172 and Noe '430 disclose and teach of a deformable mirror system as shown above, but do not specifically disclose or teach of at least one of a resistor and an element having an inductance component inserted into one of an electric circuit between the power supply and the upper electrode and an electric circuit between the power supply and the control electrode. In the same field of endeavor of deformable mirror systems, Little '309 teaches of a resistor inserted into an electric circuit between the power supply and the control electrode (Figs. 2-3; col. 6, lines 21-35; col. 6, line 46-col. 7, line 5; col. 8, lines 16-24, wherein resistive layer 46/resistive material 33 provides the resistor in an electrical circuit between the power supply and the base electrode 26) for the purpose of controlling the RC time constant and determining the rate of charge bleed off from the micro-mirror (col. 6, lines 21-35; col. 8, lines 16-24). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the deformable mirror system of Kanack '172 and Noe '430 to include at least one of a resistor and an element having an inductance component inserted into one of an electric circuit between the power supply and the upper electrode and an electric circuit between the power supply and the control electrode since Little '309 teaches of a resistor inserted into an electric circuit between the power supply and the control electrode for the purpose of controlling the RC time constant and determining the rate of charge bleed off from the micro-mirror.

Regarding **claim 6**, Kanack '172, Noe '430, and Little '309 disclose and teach of a deformable mirror system as shown above, and Kanack '172 further discloses of a deformable

mirror system wherein a member which supports one of the flexible thin film and control electrode is configured by a silicon substrate (Figs. 1-2; col. 9, lines 13-40; col. 11, lines 38-61, wherein a member which supports the control electrode 36a/46a is configured by a silicon substrate). Little '309 further teaches that the resistor is arranged on the substrate (Fig. 2; col. 6, lines 21-25).

8. **Claim 8** is rejected under 35 U.S.C. 103(a) as being unpatentable over Kanack '172, as applied to independent **claim 1** above, and further in view of Furyk '812 (US 2004/0070812).

Regarding **claim 8**, Kanack '172 discloses a deformable mirror system as shown above, but does not specifically disclose that the power supply limits the current to flow in one of the upper electrode and the control electrode of the deformable mirror, to be lower than a predetermined value. In the same field of endeavor of MEMS devices and optical micro-mirror systems, Furyk '812 teaches of a power supply limiting current flow in one of an first electrode and a second electrode of a micro-mirror, to be lower than a predetermined value (Figs. 1-4; sec. 0020-0021, 0025-0031, wherein the current flow supplied by the driver voltage is limited since the amplifier switch 400 contains current limiting resistors 350/355/440) for the purpose of using a switching network that allows a single electrode driver to do the driving work that previously required two, and that inactivates unused electrodes in a simpler and more direct manner (sec. 0007-0008, 0028-0031, wherein, since there is only a single electrode driver to do the work that previously required two, a special drive circuit that in certain instances limits the current is necessary and desirable). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made for the deformable mirror system of Kanack '172 to have the

power supply limit the current to flow in one of the upper electrode and the control electrode of the deformable mirror, to be lower than a predetermined value, since Furyk '812 teaches of a power supply limiting current flow in one of an first electrode and a second electrode of a micro-mirror, to be lower than a predetermined value for the purpose of using a switching network that allows a single electrode driver to do the driving work that previously required two, and that inactivates unused electrodes in a simpler and more direct manner.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Helmbrecht (US 2004/0165243) discloses a deformable mirror system wherein a power supply control the amount of deforming the reflecting surface by changing a duty ratio of a voltage applied.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael P. Roberts whose telephone number is (571) 270-1288. The examiner can normally be reached on Monday-Friday 8am-4/5pm with alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky Mack can be reached on (571) 272-2333. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Jessica Stultz

MPR